



Medical Use of Radiation

An overview for the Utah
Radiation Control Board

Medical Uses

- Diagnostic Uses
 - Provide information on structure (x-ray) and function (nuc. med.) of organs and tissue
 - Image quality weighed against patient dose
- Therapeutic Dose
 - Provide local control of tumors
 - Maximize dose to treatment volumes while minimizing dose to surrounding tissues and organs



Radiation Sources

- Machines
 - Provide radiation source only when powered on
 - X-rays, electrons, neutrons, protons
 - Dx: CT, Angiography, Dental, Mammography
 - Tx: PA for photons (10 to 16 MV), electrons
- Radioactive Materials
 - Always emit radiation
 - Dx: Tc-99m (6 h), F-18 (110 m), I-123 (13.2 h)
 - Tx: Co-60 (5.3 y), Ir-192 (73.8 d), I-131 (8 d)



Dose Limits

		Limit	Utah Administrative Rule
Radiation Worker	Occupational Exposure	5,000 mrem	R313-15-201
Embryo/Fetus	Occupational Exposure	500 mrem	R313-15-201
Individual Public	Infrequent Medical Exposure	500 mrem	R313-15-301
General Public	Occupational Uses	100 mrem	R313-15-301
General Public	Land Disposal Licensed Activities	25 mrem	R313-25-19
General Public	(EPA, air pathway)	10 mrem	(40 CFR 190 by reference: R313-15)
General Public	Land Disposal Licensed Activities	4 mrem	R313-25-19
Patient	Undergoing medical procedure	No Regulatory Limit	



Typical Source Activities

- Mo-Tc Generators: 1 to 16 Ci
- F-18 (FDG) shipment doses: 0.015 to 2 Ci per dose
- Teletherapy: 20 to 100 Ci per source; 4,000 to 9,000 Ci Total (100 to 200 rad/min)
- HDR Brachytherapy: ~ 10 Ci (replace 3 mo)
- I-131 Thyroid Ablation: up to 200 mCi per pt



Typical Diagnostic Doses

Procedure	Average Dose (mrem)	Aprox. Cancer Risk
CT Abdomen and Pelvis	1,500	0.06% or 6 in 10,000
CT Chest	700	0.03% or 3 in 10,000
Cardiac CT, Calcium Score	300	0.01% or 1 in 10,000
Mammogram	40	0.002% or 2 in 100,000
Chest X-ray (2-view)	10	0.0004% or 4 in 1,000,000
X-ray, Extremity	0.1	0.000004% or 4 in 100,000,000



Medical Use in Utah

- From Board Letter to Governor 3/15/2012:
 - 189 RAM Licensees
 - 47 Medical Licensees, 3 Broadscope
 - Aprox. 8,500 radiation generating machines
 - Aprox. 7,650 medical-use machines
- How many occupational workers in Medical Environment?
- How many members of public?

